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ABSTRACT

The cognitive preferences of 250 seventh grade students in social studies classes were examined, using the Cognitive Preference Profile (CPP). Each item in the CPP contains a stem statement and restatements of the stem that reflect memory, application, and questioning options. Pre- and post-test scores for the CPP were used as covariates with the independent variables of text, teacher's cognitive preference, student achievement, and student sex. There was no evidence to support the claim that students would learn to prefer critical thinking when exposed to textbooks emphasizing inquiry (questioning option) versus noninquiry (memory/application options). Teachers with cognitive preferences for memory and application tended to produce similar cognitive preferences among their students. Teachers with inquiry preferences were not as successful in developing similar preferences; their students tended to prefer the application options on the CPP. Although all three achievement groups (high-medium-low) showed dramatic shifts toward application preferences, the high achievers preferred memory options more than the other two groups. Low achievers showed the highest preferences for questioning options. Contrary to expectations, no sex differences in cognitive preferences were evident. (RL)

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COGNITIVE PREFERENCE TESTING: Process Evaluation of Inquiry Strategies

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Cognitive Preference Testing:

Process Evaluation of Inquiry Strategies

I have this pine tree, about four feet tall. It sits in a bucket in my backyard. Occasionally I feed it coffee grounds, because I heard somewhere that might be good for it. I observe that it is still green. I see that its needles are not falling off; that the spindly trunk is yet straight and seems to give purpose to the rest of it. But I do wonder sometimes about the effect of Maryland Club on a four-year old loblolly.

If you're clever at analogies, you may have already discerned why I have been reflecting on that pine tree. To be sure, a similar story continues to unfold, and I'd like to share it with you.

Statement of the Problem

Since the late nineteenth century, curricula and objectives have changed with the forces of political power. For example, social studies curricula have seen an emergence from the tradition of memorization of facts in history, government, and geography to new concerns more reflective of contemporary currents (Davis, 1976). Each era had its impact on social studies: the Depression brought reform and education for citizenship; World War II brought increased conservatism and reflective thinking; postwar reaction-

aries and McCarthyism revived teaching of facts and memorization.

During the late 'fifties and early 'sixties the memorization of facts was abruptly halted in the wake of a Russian satellite. The resulting transformation of curricula for science and mathematics spilled over into social studies. Curricula for all areas began to be focused on concepts and theories (Piaget, 1969); discovery learning and inductive teaching became the process and method in the prosperity of the 1960's. In recent years, the "new" curricula of the 1960's has apparently become the quicksand curriculum of the 70's. Indeed, numerous innovative teaching strategies have appeared and rapidly disappeared during the last decade like ghosts in a swamp. From the outset, new English and new math generally bewildered teachers and parents. Teachers were relatively untrained to handle the content objectives, let alone the process goals, of an activity-centered curriculum (Wadsworth, 1978). Ensuing attempts were made to introduce the essential materials, which were not traditional textbooks and workbooks, but were, instead, boxes of various provisions. School boards and textbook adoption agencies sat in a mudhole when faced with the concept, not to mention the price tag, of a packaged curriculum. When a congressional committee entered the fray with sensational controversy over the MACOS curriculum, the mudhole became a quagmire. Appropriately enough, during the last decade curriculum writers and curriculum buyers got together in a foggy bottom

and called it "Back to Basics". But what is more interesting is to note the survival instincts of the proponents of hands-on materials and activity-centered strategies, particularly in the sciences. A recent example of this is found in an excerpt from "The New Rand McNally SCIIS" brochure:

> All program components reinforce learning of major concepts and processes, and encourage scientific attitudes...The major objective...is to help children become <u>scientifically literate</u> (emphasis theirs).

However, there is residual concern for teacher implementation of programs like these in all areas. How do we evaluate the process learning objectives, the student "attitudes" toward learning? What is the "mode" of the classroom? Are students really learning to investigate and to analyze, or are they cleverly memorizing?

During the mid 'sixties concern emerged for assessing cognitive processes apart from content mastery. Research based on cognitive preference testing was initiated by curriculum evaluators in the sciences (Heath, 1964) specifically to focus on what the student <u>was likely to do with</u> given information, as opposed to what the student <u>knew</u> in relation to the facts given. This testing format generally provided for a variety of correct statements, each of which implied a specific thought process (e.g., memory, application, and questioning,) and from these the student selected the statement <u>preferred</u>. Test results provided a reasonably

effective evaluation of new science curricula, particularly with regard to showing an increase in student preference for critical thinking processes. However, the activity-centered materials and objectives that have grown in influence in all content areas of the curriculum are lacking in summative evaluation of student learning process goals. A search of the Education Index and ERIC revealed that no study explored the use of cognitive preference testing in social studies. Therefore, the following study (Heller, 1977) was focused on one area, Texas History, for investigation, based on related research in the sciences (Barnett, 1973; Kempa and Dube, 1973; Tamir, 1975).

Insert Table 1 About Here

Design of the Study

The study was conducted in ten seventh grade Texas History classes (N=250). Of the ten teachers participating in the study, eight represented five different public schools and two were from different private schools surrounding the Austin (Texas) area. During the initial meeting with each teacher the CPE-II (Atwood, 1971) was administered with the result that three (M)-, four (A)-, and three (Q)-preferenced teachers were identified as compromising the sample studied.

Table 1

Summary of Research Results of Seven Cognitive Preference Tests

Study and Year	Level & Content Area	Groups Compared	Number of test items	Findings* (M)	(A)	(P)	(Q)
Heath, 1964	10-12, Physics	PSSC students v. non-PSSC	20	Non-PSSC	N.S.	PSSC	PSSC
Marks, 1967	11-12, Chemistry	CBA students v. non-CBA	100	Non-CBA	CBA	N.S.	CBA
Atwood, 1967/68	11-12 Chemistry	CHEM-Study students v. non-CHEM-Study	34	Non-CHEM-Study	N.S.	CHEM-Study	CHEM-Study
Atwood, 1971	Jr.-Sr., College Elem. Ed.	Two groups of pre-service teachers	27	Pre-test scores	Post-test scores	---	N.S.
Kempa & Dube, 1971	11, Chemistry (England)	High and Low Achievers	40	Low-Achievers	Low-Achievers	High-Achievers	High-Achievers
Barnett, 1973	10, Biology	High and Low Achievers	25	Low-Achievers	N.S.	N.S.	High-Achievers
Tamir, 1970-74	10-12, Biology	BSCS students v. non-BSCS	40	Non-BSCS	Non-BSCS	BSCS	BSCS

*The groups appearing in these colums represent those with the significantly higher scores of the groups (or students) compared.

The Cognitive Preference Profile: Texas History (CPP, hereafter) was the instrument developed for the study. A sample item from the CPP illustrates the various components of the basic cognitive preference test:

> Jean Luis Berlandier drew a picture of Goliad in 1829 when it was a town of about 500 people.
>
> a. Berlandier's drawings from Goliad and other settings are important for showing the different ways of living among various Texas tribes.
> b. Berlandier was a Frenchman who visited the Southeast portion of Texas from 1828-1829.
> c. Though he made several good drawings during his visit, Berlandier was actually a French scientist more than an artist.

Specifically, each test item contains: (1) a stem statement - information representative of a single fact or concept; (2) a memory (M) option - restatement of the stem item in a factual way, or related item showing simple recall; (3) an application (A) option - relating the stem item to a function, or to extend meaning; and,(4) a questioning (Q) option - critical analysis or evaluative statement regarding the stem item.

The CPP was administered during the first two weeks and last two weeks of the 1976 fall quarter. Pre/posttest scores were used as covariates with the following independent variables: text, teacher cognitive preference, student achievement level, and sex of student. Standard statistical procedures were employed for computing a four-way analysis of covariance (see Statistical

Package for the Social Sciences, 1975).

Insert Table 2 About Here

Results and Discussion

The overall objective of this study was to explore cognitive preferences of students within the field of social studies. The initial question asked: Do student cognitive preferences change in social studies classrooms? For instance, outcomes of daily classwork and testing in an activity-centered classroom might be expected to influence student thinking processes toward preferring critical questioning. In a four-year longitudinal study conducted in biology, cognitive preferences of high school students were shown to change as a result of either BSCS or non-BSCS curricula (Tamir, 1975).

The results of the CPP study displayed a significant difference between students' overall and first preference scores at the .01 level and .05 level, respectively (see Tables 3 and 4). This indicates that the CPP was successful in showing change in student patterns of process thinking.

Insert Tables 3 and 4 About Here

Table 2

Means and standard deviations for variables and pre-posttest covariables across student cognitive preferences for memory (M), application (A), and questioning (Q) categories.

VARIABLE	PRETEST			POSTTEST		
	(M)	(A)	(Q)	(M)	(A)	(Q)
SEX						
Males	2.013	1.955	2.031	2.018	1.862	2.120
	.261	.211	.216	.254	.222	.236
Females	2.042	1.930	2.072	2.002	1.845	2.151
	.258	.205	.240	.263	.201	.286
TEXT						
Kownslar	2.013	1.950	2.036	1.997	1.862	2.141
	.254	.202	.234	.256	.207	.245
Other	2.042	1.936	2.020	2.026	1.845	2.128
	.265	.215	.221	.261	.218	.280
ACHIEVEMENT						
Low	1.969	1.969	2.029	1.992	1.931	2.076
	.257	.231	.202	.243	.209	.235
Medium	2.032	1.946	2.020	2.047	1.827	2.124
	.268	.221	.238	.249	.208	.260
High	2.065	1.916	2.017	1.964	1.835	2.201
	.240	.158	.229	.278	.209	.273
TEACHER COGNITIVE PREFERENCE						
Memory	2.031	1.938	2.029	1.976	1.844	2.178
	.272	.212	.241	.260	.251	.259
Application	2.031	1.946	2.022	2.055	1.854	2.089
	.247	.201	.208	.240	.184	.248
Questioning	2.017	1.944	2.037	1.990	1.863	2.148
	.263	.215	.240	.273	.203	.275
Total	2.027	1.943	2.029	2.011	1.854	2.135
	.259	.208	.228	.258	.212	.261

Table 3

Analysis of Covariance of Overall Pre-posttest Preference Scores of Students

Covariables	Sum of Squares	DF	Mean Square	F	Significance of F
M_{pre} with M_{post}	.510	1	.510	7.868	.005
A_{pre} with A_{post}	.293	1	.293	7.041	.009
Q_{pre} with Q_{post}	.960	1	.960	15.173	.001

Table 4

Analysis of Covariance of Pre-posttest First Preference of Students

Covariables	Sum of Squares	DF	Mean Square	F	Significance of F
$M_{pr.1}$ with $M_{pos.1}$	18.239	1	18.239	4.154	.043
$A_{pr.1}$ with $A_{pos.1}$	34.108	1	34.108	9.318	.003
$Q_{pr.1}$ with $Q_{pos.1}$	42.159	1	42.159	10.540	.001

What are the effects of inquiry vs. non-inquiry text books on student cognitive preferences? Unfortunately for the authors of the inquiry text, there was no evidence to support the claim that students would learn to prefer critical thinking. In fact, the preference means for both groups changed in the direction of (A).

What is the effect of teacher cognitive preference on student process learning? Teachers who were shown to prefer (M) or (A) tended to produce similar preferences among their students. Teachers who were (Q) - preferenced were not likewise successful; their students tended to show preference for (A) instead.

Another question to be answered was: Do students of different achievement levels exhibit different cognitive preferences? Interestingly, while all three high/medium/low achievement groups showed dramatic change toward preferences for (A), the high achievers preferred (M) more than the other two groups. Equally disturbing was the discovery that low achievers showed the highest preference for (Q). These results were diametrically opposite to findings by Kempa and Dube (1973) who studied students in chemistry curricula. However, in viewing the results of the main effect of achievement alone (see Table 5), it may be sufficient to note Tamir's (1975) conclusion that cognitive preferences are "at least partially discipline and subject matter dependent" (page 262).

Insert Table 5 and Figure 1 About Here

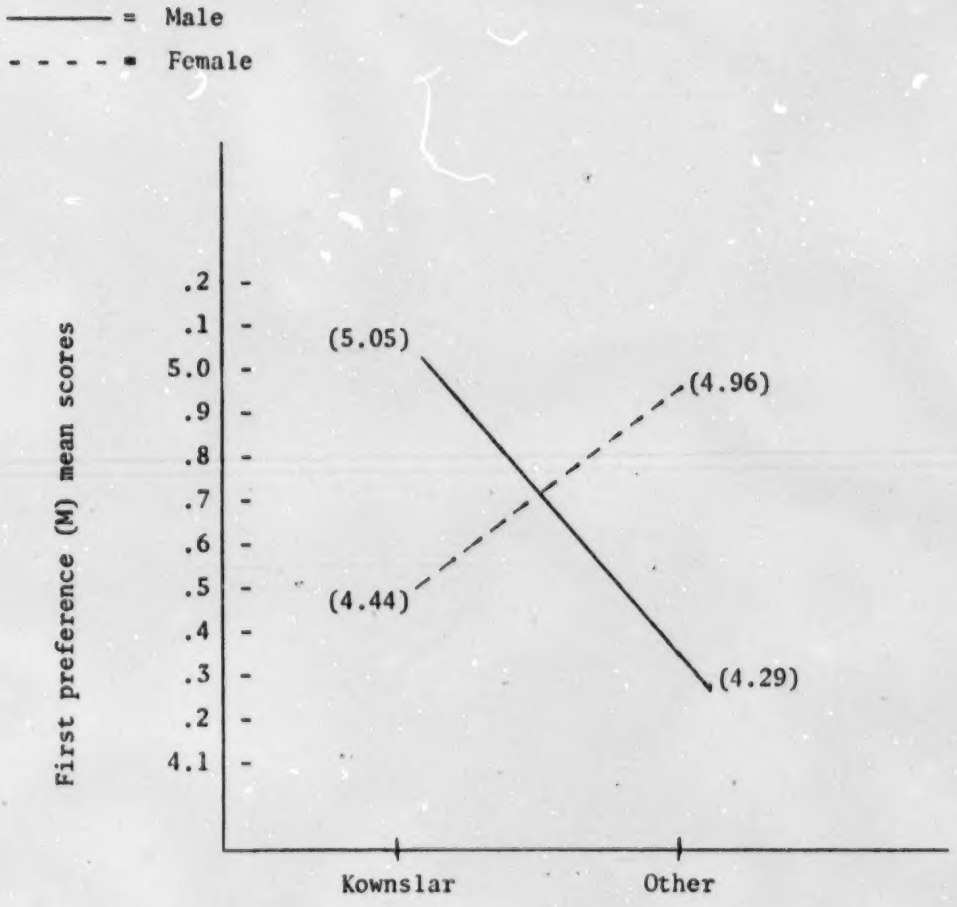
The fourth area investigated was differences between cognitive preferences by sex of student. Overall, there seemed to be no significant difference, which was startling in view of the research that indicated otherwise. However, there was significant interaction between the main effects of sex and text. In fact, boys and girls responded to the two types of text in the opposite manner. Boys preferred (M) when using the inquiry text, and girls preferred (M) when using the non-inquiry text (see Figure 1). Reasons for such a remarkable relationship are not readily apparent; however, a three-way interaction was found between sex of student, text, and achievement which corroborated the two-way interaction findings. For example, a social studies teacher might plan to use an inquiry text with girls and a non-inquiry text with boys if the desired outcome is to promote (A) process thinking. In fact, one of the major conclusions of recent research is congruent in finding that "different combinations of student characteristics (i.e., sex and aptitude), the school environment, the curriculum studies, (and) the curricular bias of teachers result in different outcomes regarding student process thinking" (Tamir, 1975).

Table 5

Analysis of Covariance of Overall Scores with the Main Effect of Achievement

Covariables	Sum of Squares	DF	Mean Square	F	Significance of F
M_{pre} with M_{post}	.301	2	.150	2.320	.101
A_{pre} with A_{post}	.458	2	.229	5.503	.005
Q_{pre} with Q_{post}	.525	2	.263	4.151	.017

Figure 1: Interaction between sex and text comparing student first preference (M) mean scores



Preliminary Findings From the Current Pilot Study

Currently, another study is underway to investigate the effect of curricular bias in fifth grade science classes. Preliminary findings indicate that students in a non-inquiry curriculum ("Birds of Prey", AISD, 1977) show a strong preference for memory processes ($P<.01$), followed in order by application and questioning ($N=54$) (see Table 6).

Insert Table 6 About Here

A closer look, however, reveals basic differences between first preferences of boys and girls, with the result that boys overwhelmingly prefer (M) and girls show a 50/50 split preference for (M) and (A), (see Table 7).

Insert Table 7 About Here

Examination of the curricular material shows an application orientation. Therefore, the new data may be further evidence of a curriculum effect on females, and a "non-effect" on males. This interpretation would be consistent with findings from the major study at seventh grade levels.

Of final interest to both studies is the role of the teacher. The current investigation involves two (M)-preferenced teachers who

Table 6

Frequency of response on CPP: Birds of Prey across categories for memory (M), application (A), and questioning (Q).

PREFERENCES	(M)	(A)	(Q)
First	108 (41.7%)	88 (34.0%)	63 (24.3%)
Second	91 (35.1%)	81 (31.2%)	87 (33.7%)
Third	61 (23.6%)	85 (32.8%)	113 (43.6%)

Table 7

Frequency of first preference response, comparing males and females across categories for (M), (A), and (Q).

	(M)	(A)	(Q)
MALES (n=27)	53 (42.1%)	37 (29.3%)	36 (28.6%)
FEMALES (n=27)	54 (40.6%)	51 (38.3%)	28 (21.1%)

are showing moderate successes in influencing their students toward memory-process thinking. Recall that in the previous study (M) and (A) teachers were able to elicit similar process-thinking responses from their students (Heller, 1977). However, the teachers with a preference for (Q) failed to accomplish the same measure of agreement with their classes. What could account for this failure? Since traditional classroom objectives and strategies have been more (M) and (A) centered, it is plausible that teacher behavior continues to follow those role patterns in spite of a preference for (Q). Further evidence of this possibility lies in the fact that not one class using an inquiry text showed a higher mean preference for (Q). Regardless of teacher preference, the inquiry text alone might have been expected to have some impact on student attitudes in the direction of (Q). In fact, it did not. Since neither the teacher nor the text had any apparent effect to move preference toward critical thinking, the test results may be pointing to teacher behavior. Perhaps these teachers were unable to put theory into actual practice. Clearly, (Q)-preferenced teachers using a (Q)-designed text have not produced convincing evidence to the contrary.

Implications

The role of the teacher is to create an inquiry environment so rich with phenomena that the student feels the nudge ---

disequilibrium -- the essential first step in cognitive development (Butler, 1976; Scott, 1976). There has been some confusion among teachers as to what are the active modes of learning for students beyond the primary levels. Some areas have been helped by the proliferation of simulations and games and other media packages for hands-on learning at intermediate and secondary levels. But the problem remains that teachers implementing these materials in the classroom are being held accountable for showing student mastery of content and skills. Once again it is painfully true that when you're up to your neck in alligators, it's difficult to remember that the primary objective was to drain the swamp. The primary objective in implementing those materials is to promote the critical thinking process. But we haven't given teachers a tool for evaluating that objective.

Process evaluation has been an elusive component of the classroom curriculum -- assessing what the student is likely to do with the materials and information presented has been a lot like trying to nail jello to a tree. In a related effort, Wadsworth (1978) has developed a set of 29 tasks to introduce teachers to the assessment of student cognitive structures development, using Piagetian interview techniques, at both elementary and secondary levels. Unfortunately, an individualized clinical assessment, even for the teacher who has a total class enrollment of only 25 (which seldom occurs at secondary levels), would be a remarkable feat indeed.

Although cognitive preference testing measures a different aspect of Piagetian constructs for cognitive development, it is first of all, a practical means of providing an individual profile of the student's progress toward accepting modes of critical thinking. Secondly, the Cognitive Preference Profile affords the teacher a general assessment of the mode of learning in the classroom. Specifically, it can be used as a tool for evaluating the primary objectives of activity-centered curriculum materials and strategies. More generally, this kind of test in the hands of the teacher could be like holding a mirror on one aspect of teaching effectiveness. The teacher may be afforded a self-evaluative view on the effect of his implementation of Piagetian strategies and techniques -- an insight on his ability to influence student thinking "attitudes" -- a glimpse of the learning environment he has helped to create.

Piaget (1972) writes:

> ...to understand is to discover, and such conditions must be complied with if in the future individuals are to be formed who are capable of production and creativity and not simply repetition. (p. 20)

A means for providing evidence of this phenomenon may be forthcoming through cognitive preference testing.

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